

WHAT IS CLAIMED IS:

1. A continuous underground trench excavator comprising:
 - a trencher having an excavating element;
 - a travel body which supports said trencher vertically movably, said travel body causing said trencher to move substantially vertically and substantially horizontally to form a continuous trench;
 - a penetration resistance calculating means for calculating a penetration resistance under penetration of said trencher to a predetermined underground depth;
 - a ground strength estimating means for estimating a ground strength in a direction of the underground depth from said penetration resistance; and
 - an excavation control means for making control so that excavation is carried out with a thrust matching the estimated ground strength.
2. The continuous underground trench excavator according to claim 1, further comprising:
 - an excavation energy calculating means for calculating excavation energy for unit depth on the basis of said penetration resistance, and
 - wherein said ground strength estimating means estimates said ground strength from said excavation energy.
3. The continuous underground trench excavator according to claim 1, wherein said trencher is a cutter post having said excavating element.
4. A continuous underground trench excavating method using the continuous underground trench excavator of claim 1, comprising the steps

of:

determining a penetration resistance with use of said penetration resistance calculating means under penetration of said trencher to a predetermined depth;

estimating a ground strength in a direction of the underground depth on the basis of said penetration resistance; and

performing vertical excavation in which said trencher is inserted into the ground with a thrust matching the estimated ground strength and horizontal excavation in which said travel body is moved substantially horizontally to allow said trencher to perform excavation in a horizontal direction, thereby to form a continuous trench.

5. The continuous underground trench excavating method according to claim 4, further comprising the step of:

determining excavation energy required for unit depth on the basis of said penetration resistance, wherein, from the excavation energy, a ground strength is estimated in the direction of the underground depth.

6. The continuous underground trench excavating method according to claim 5, wherein an N value which represents the ground strength is estimated from said excavation energy as estimated N value.

7. The continuous underground trench excavating method according to claim 6, further comprising the steps of:

calculating an average depth under a horizontal ground reaction force on the basis of the estimated N value;

calculating an average horizontal ground reaction force from the

average depth;

calculating a projected excavation area in a vertically downward direction and a projected excavation area in horizontal excavation; and

estimating an excavation speed in horizontal excavation from a surface pressure acting on said each projected excavation area and an excavation speed.

8. The continuous underground trench excavating method according to claim 4, wherein a ground reaction force in horizontal excavation by said trencher is calculated and excavation energy at a unit horizontal distance is calculated from said ground reaction force to measure an excavation load and perform excavation simultaneously.

9. The continuous underground trench excavating method according to claim 8, wherein the excavation is controlled so that a varying quantity of the excavation energy at said unit horizontal distance which is calculated with the lapse of time on the basis of the horizontal excavation falls under a predetermined range.

10. The continuous underground trench excavating method according to claim 9, wherein said trencher is moved horizontally with said trencher inserted into an underground supporting layer to effect trench excavation, and said trencher is controlled in a depth direction so that the varying quantity of excavation energy at said unit horizontal distance falls under the predetermined range.

11. The continuous underground trench excavating method according to claim 9, wherein an adjusting excavation is performed when the varying

quantity of excavation energy at said unit horizontal distance deviates from the predetermined range.